Reduced Air Emissions for Hard Chrome Plating at the NADEP NAS North Island, San Diego

Using an Alternative Emission Control Technology

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
26 FEB 2004	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Reduced Air Emissions for Hard Chrome Plating at the NADEP NAS North Island, San Diego Using an Alternative Emission Control Technology	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Palm International, Incorporated**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM001865, Industrial Process and Energy Optimization. Proceedings of the Industry Workshop Held in Gettysburg, PA, 25-27 February 2004., The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**28**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

The NADEP's Hard Chrome Plating Facility

The NADEP facility located on the NAS North Island, San Diego, CA currently has five (5) hard chrome plating tanks in operation. The facility typically plates 3-5 million amp-hours per year and is identified as a Small Hard Chromium Electroplating Facility by the San Diego Air Pollution Control District.

The NADEP's Cr^{+6} Permit Conditions

"THE HEXAVALENT CHROMIMUM EMISSIONS SHALL NOT EXCEED 0.233 POUNDS IN EVERY CONSECUTIVE 12-MONTH PERIOD. THE HEXAVALENT CHROMIUM SHALL BE DETERMINED USING THE THREE MOST RECENT APPLICABLE SOURCE TESTS APPROVED BY THE DISTRICT* FOR THE ABOVE EQUIPMENT."

*** San Diego Air Pollution Control District**

The NADEP's Current Air Pollution Control Device

The NADEP currently incorporates a 40,000 CFM Mesh Pad Mist Eliminator Exhaust System driven by a 100 HP motor as its add-on control device. The measured Cr^{+6} emissions at the stack is 0.0015 mg/amp hour. At this emission level, the NADEP could plate approximately 70 million amp hours annually and remain in compliance with their permit. The exhaust fan motor is operated 24 hours per day 7 days per week at an average cost of 10.7 cents per kilowatt hour.

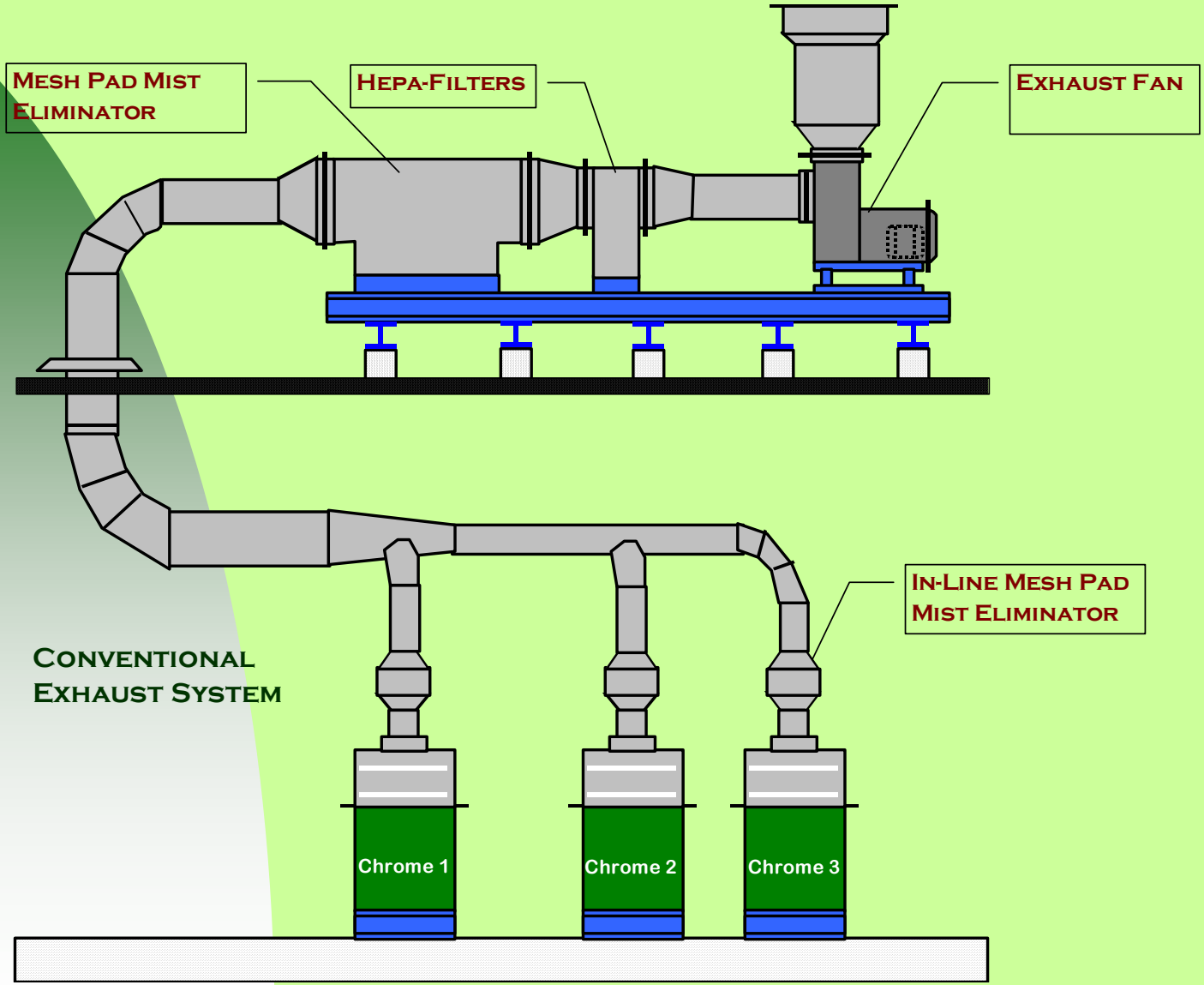
ENCAPSULATING TANK COVERS

This presentation addresses the implementation of encapsulating tank covers, hereafter referred to as the Chrome Plating Emission Elimination Device (EED), on the NADEP's hard chrome plating process tanks, as an alternate control devise used to eliminate Cr^{+6} emissions to the outside environment, reduce operating costs, and provide enhanced operator safety and exposure in the chrome plating facility.

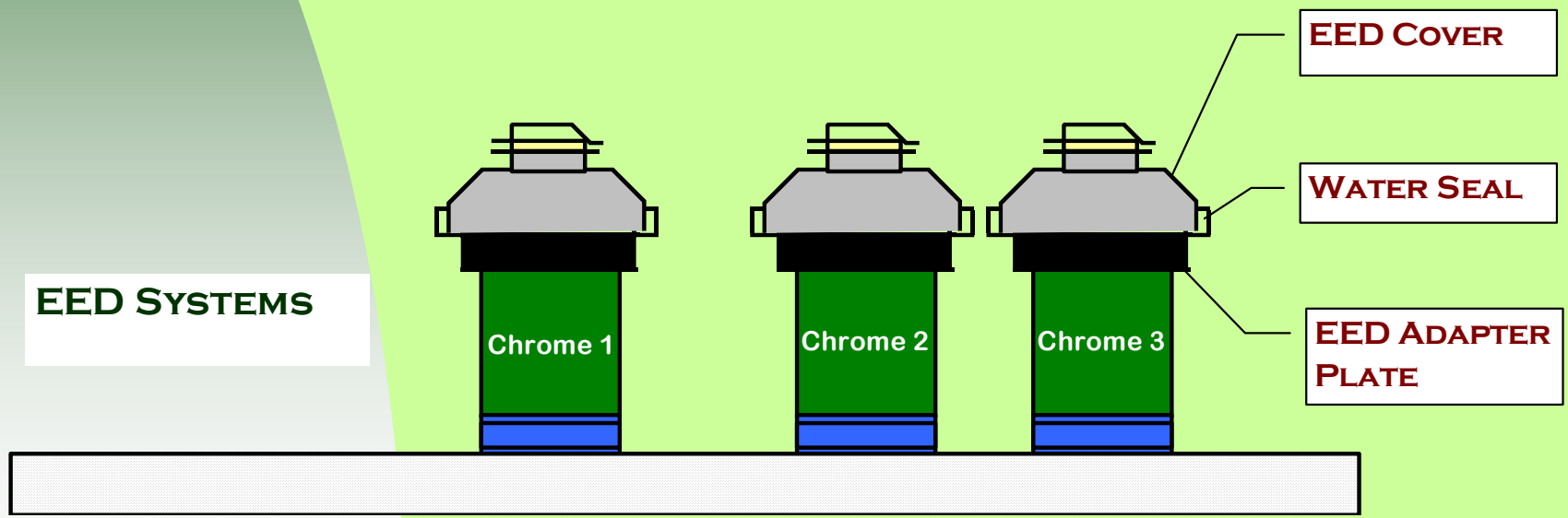
EED DEFINITION

As a stand-alone, self-contained system requiring no exhaust fans, scrubbers or mesh pad mist eliminators, fume suppressants, or exhaust ducts and vents to the outside environment, the EED System has by definition, zero emissions to the outside environment.

CONVENTIONAL EXHAUST SYSTEM



SAME TANKS WITH EED SYSTEM



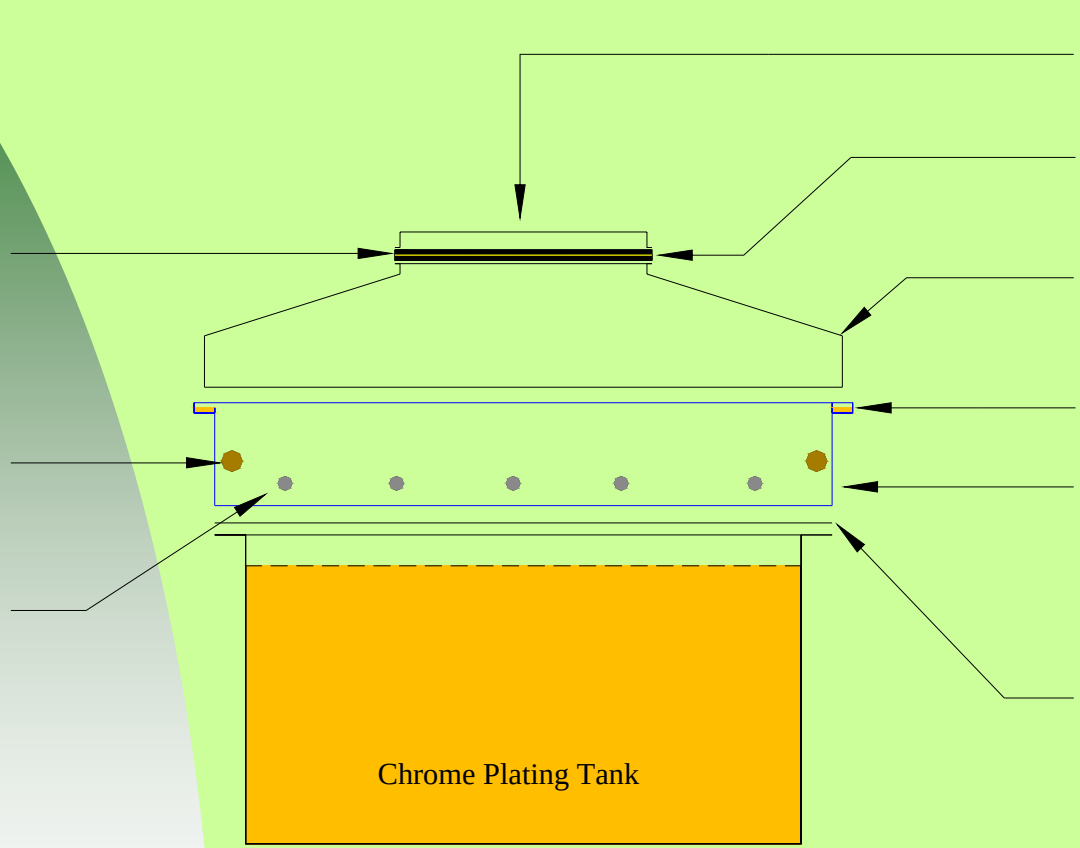
EED Systems

BUILDING AN EED SYSTEM

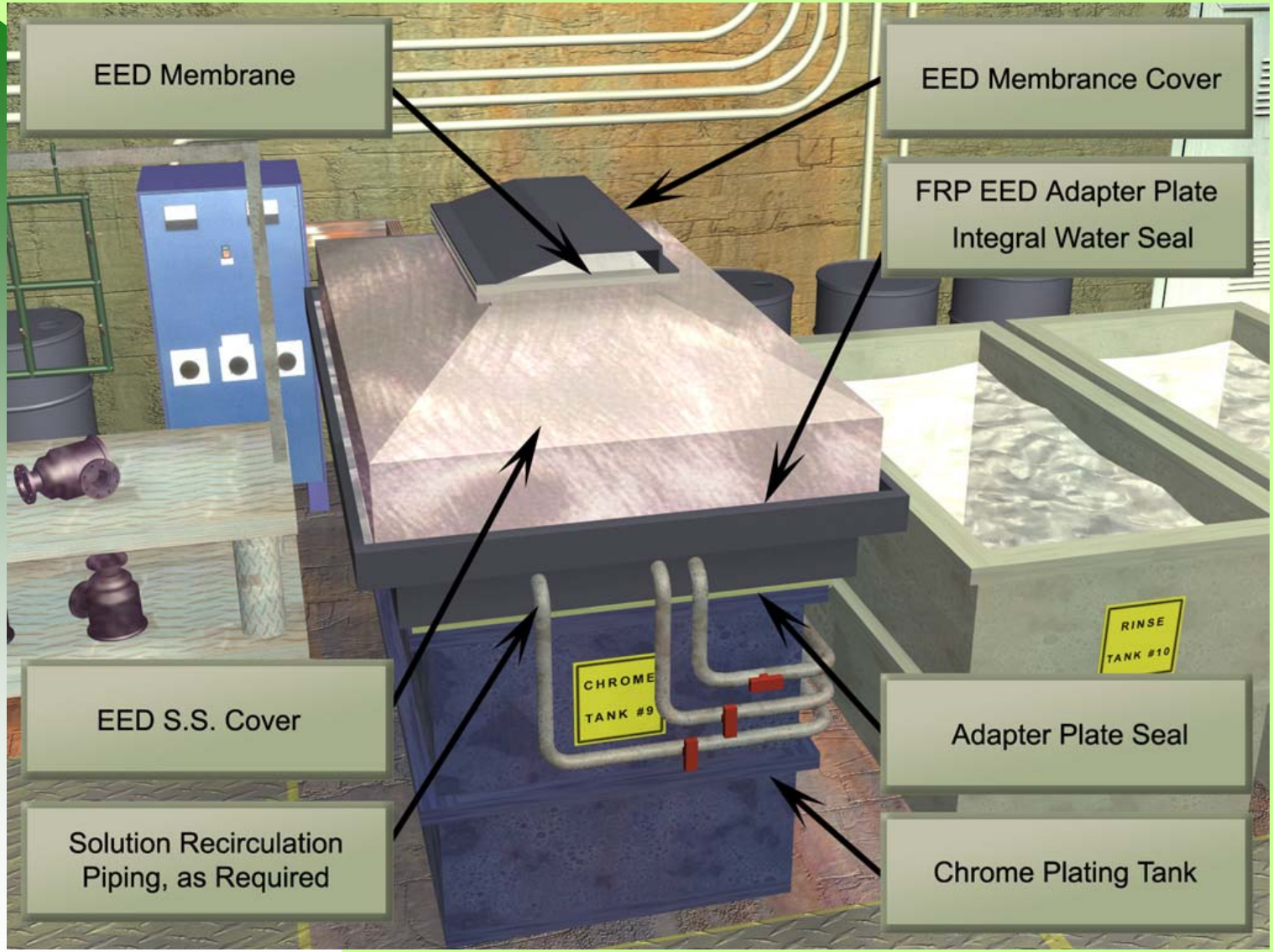
The EED system is comprised of the following components:

- Chrome Plating Tank
- Adapter Plate-Tank Lip Seal
- EED Adapter Plate w/Water Seal
- EED Membrane & Frame
- EED Membrane Cover
- EED Evacuation System

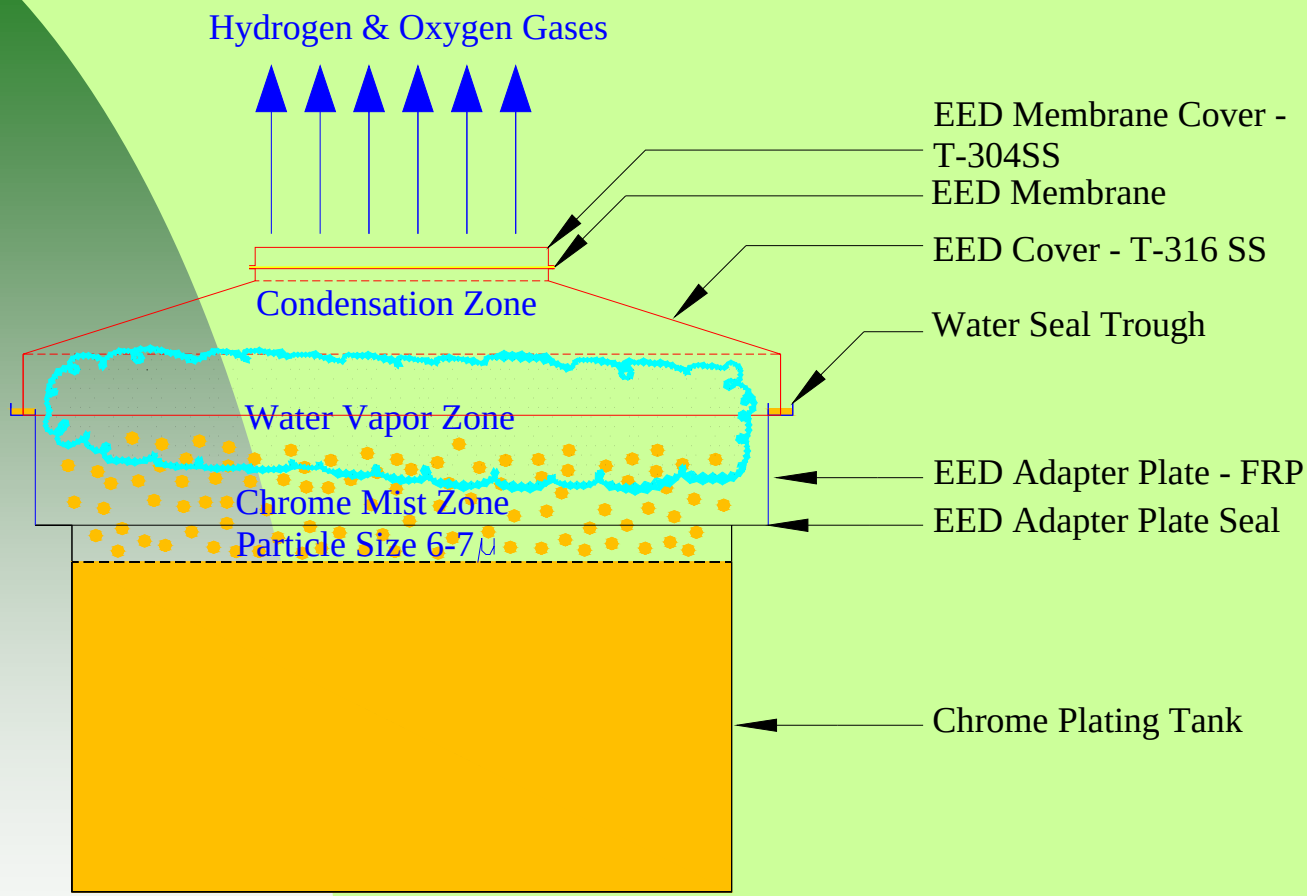
BUILDING AN EED SYSTEM



BUILDING AN EED SYSTEM



THEORY OF OPERATION

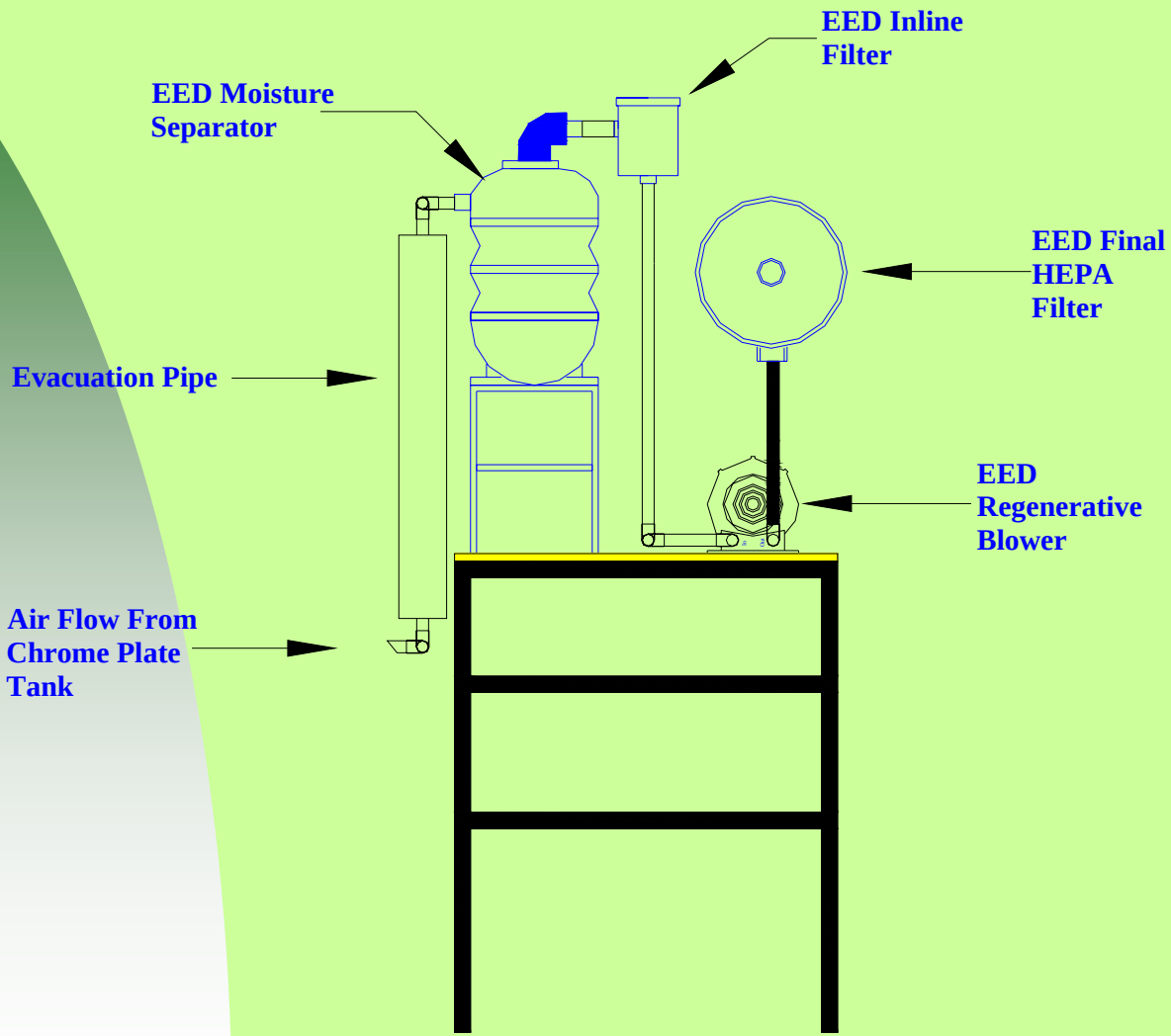


THEORY OF OPERATION

EED Operation:

As chrome plating takes place, several things occur simultaneously beneath the EED cover. Water vapor is created due to the 135ºF operating temperature of the hard chrome bath. Chrome mist is generated due to electrolysis. Additionally, hydrogen and oxygen gasses are created at the cathode and anode due to the inefficiency of the hard chrome plating bath. As the water vapor rises beneath the cover, a cloud forms blanketing the plating solution. Chrome mist that comes in contact with the cloud is “washed” by the water vapor, creating heavy chrome droplets that fall, by gravity, back into the plating tank. As the water vapor continues to rise, it comes in contact with the cover, condenses, forms water droplets, which in turn fall back into the water seal trough and plating tank. The hydrogen and oxygen gasses rise to the highest point beneath the cover where the patented membrane allows free passage of these gases into the atmosphere.

THE EVACUATION SYSTEM

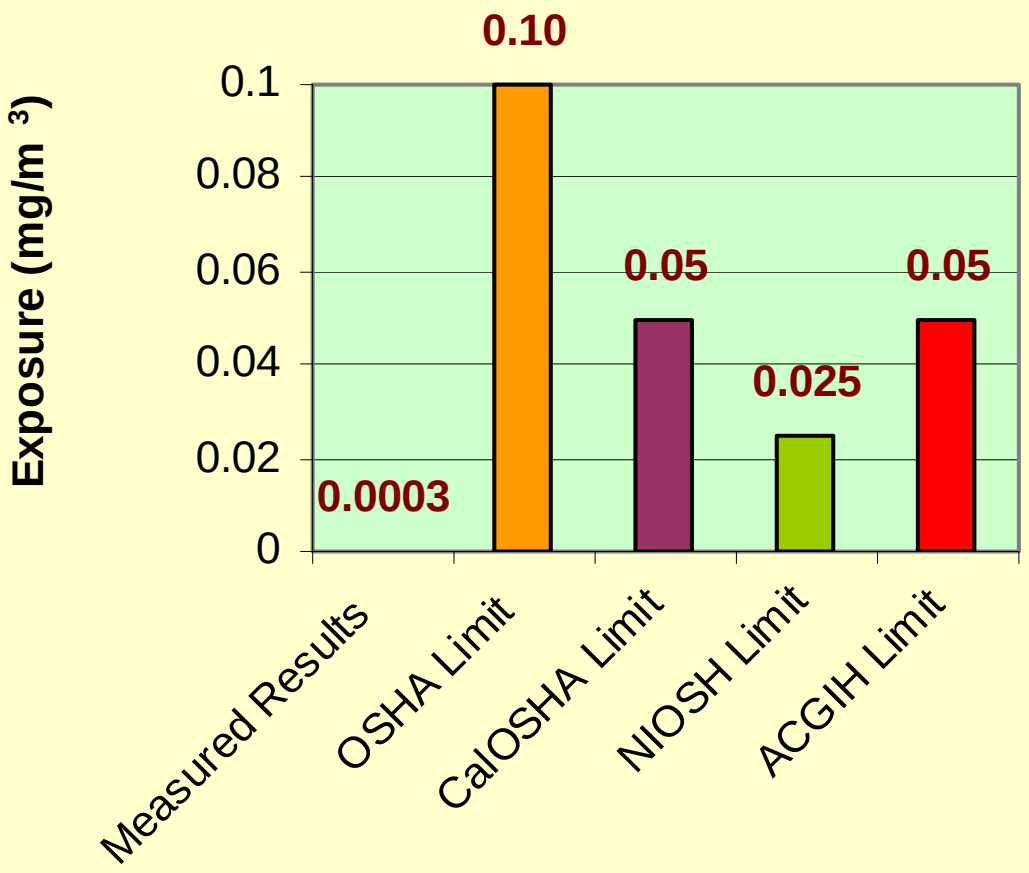


THE EVACUATION PROCESS

Evacuation System Operation:

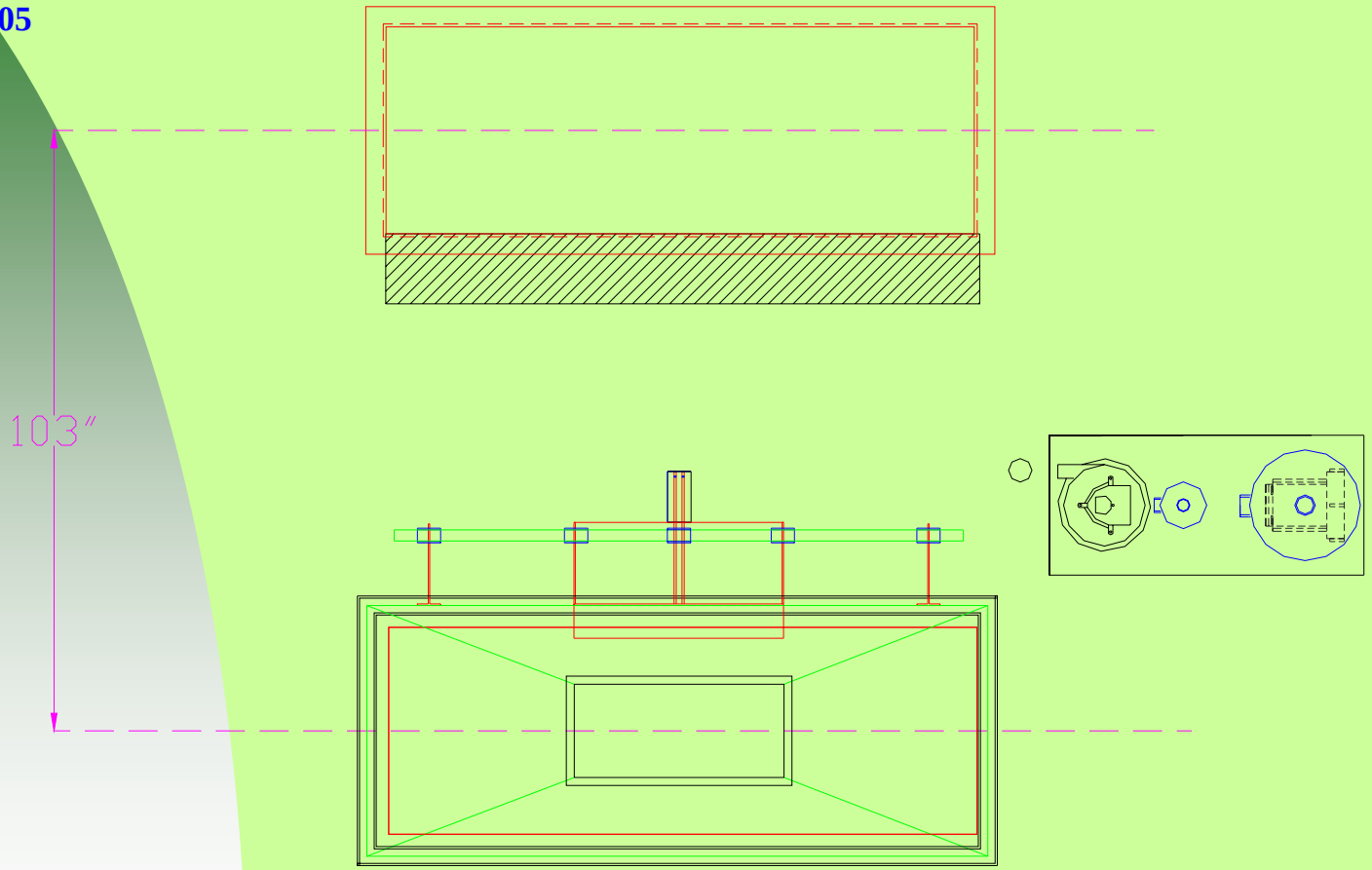
On completion of the plating cycle, residual hydrogen and oxygen gasses and water vapor must be evacuated from the unit prior to opening the cover. Once the rectifier has been turned off, it takes approximately 3-5 minutes to complete this effort. The evacuation system consists of a regenerative blower, moisture separator, pre-filter and final HEPA filter. The operation is as follows: The blower is activated, the air flow passes through the moisture separator where residual moisture is collected, through the pre-filter, into the blower, and finally into the room atmosphere through a 0.3 micron HEPA filter.

AIR QUALITY MONITORING



PROPOSED NADEP EED SYSTEM, TANK NO. 1

NADEP Building 472
Chrome Plating Area
EED System 1005



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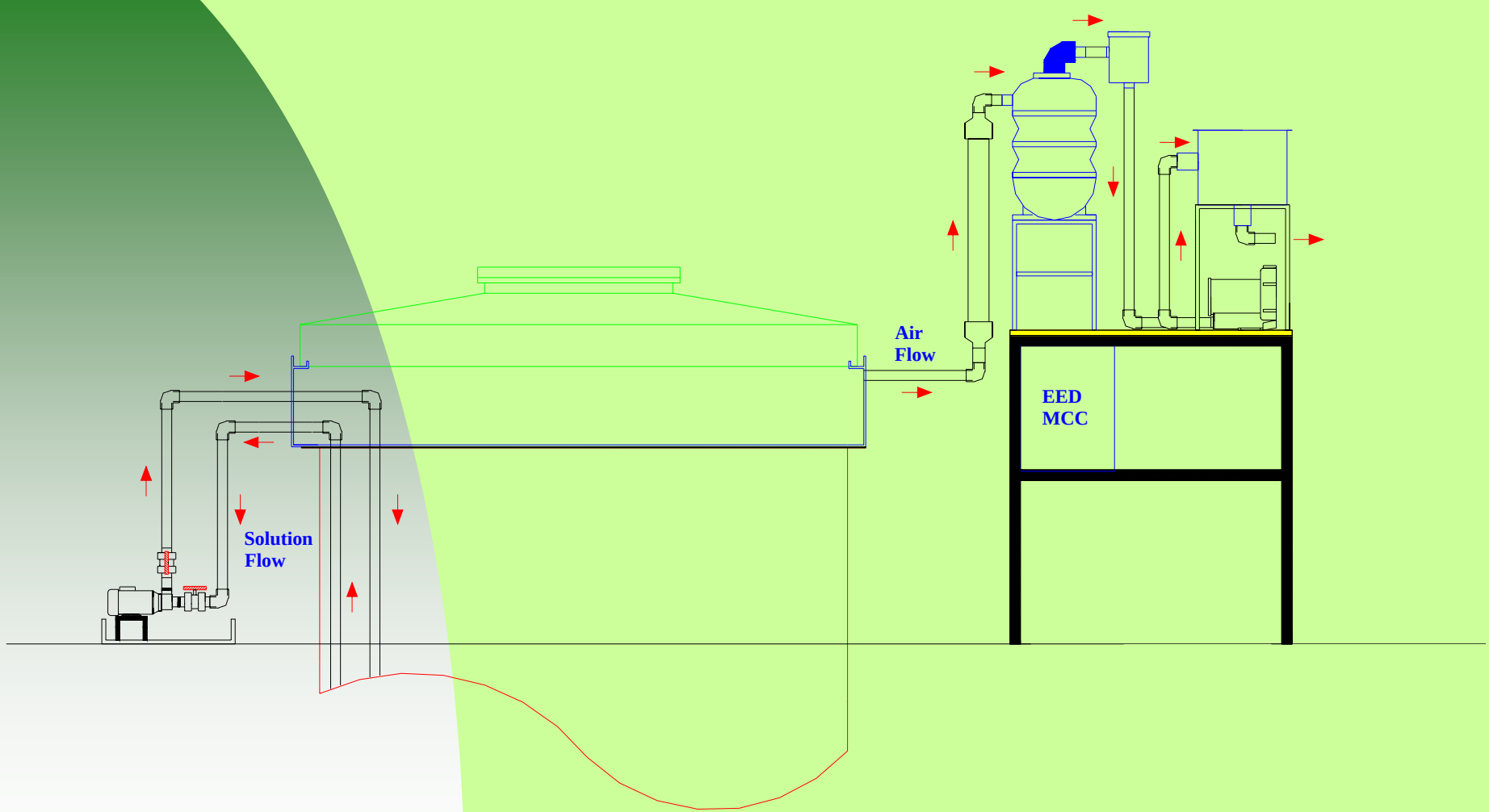
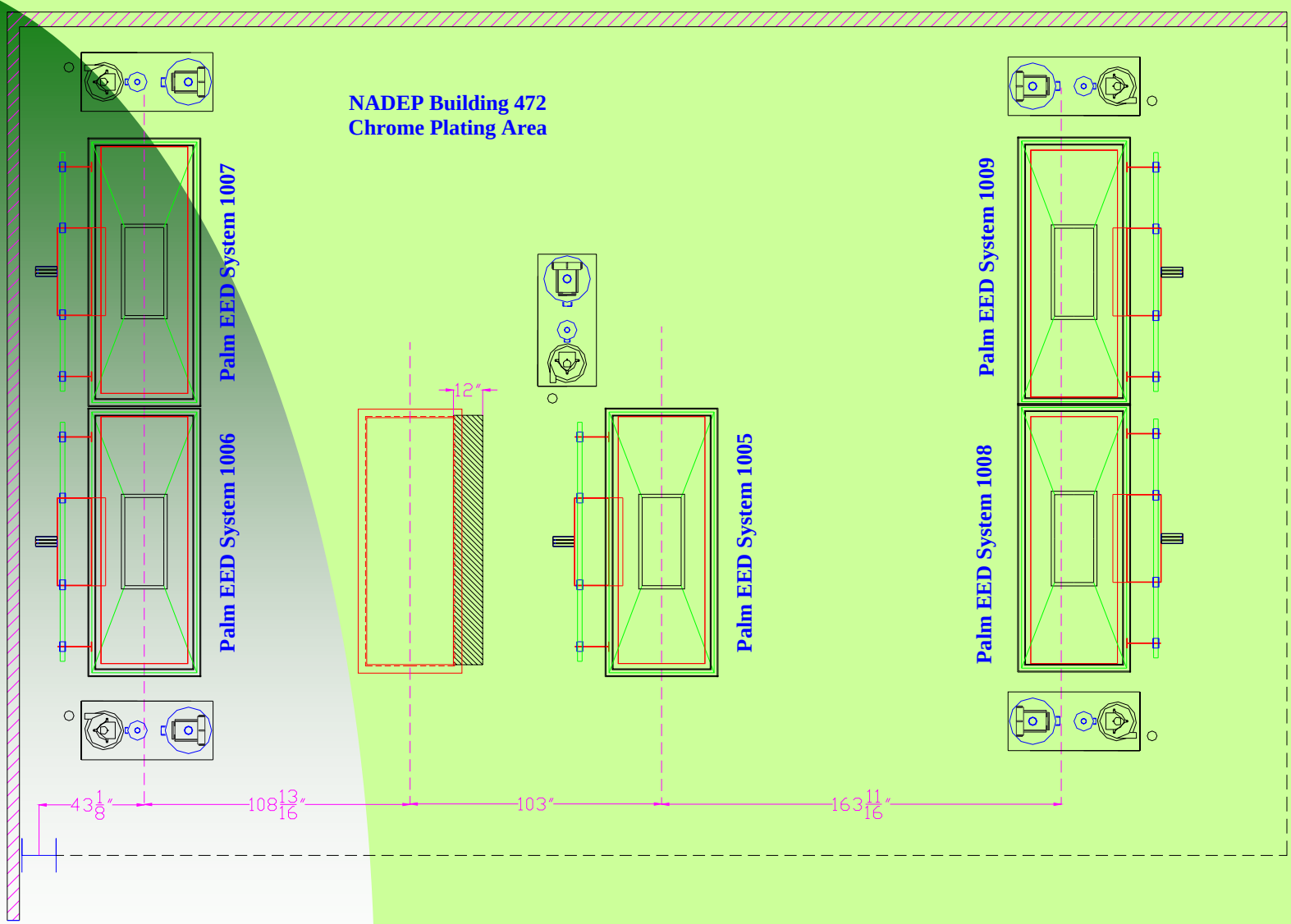


PROPOSED NADEP EED SYSTEMS



ADVANTAGES OF THE EED

SAVINGS

- Associated scrubber costs are eliminated.
- Potentially leaking ductwork eliminated.
- Heated make-up air requirements are eliminated.
- Fume suppressants are no longer needed.
- Energy requirements are reduced by 60-70%.
- Floor space requirements could be reduced.
- Long life estimated to be 15 years or longer.

COST SAVINGS

ESTIMATED EED COST & PAYBACK ANALYSIS

FIVE-TANK SYSTEM
NADEP - SAN DIEGO, CA
TANK SIZE - LENGTH: 101" X WIDTH: 34"

CONVENTIONAL CHROME PLATING TANK			CHROME PLATING TANK W/EED SYSTEM		
			EED EQUIPMENT COST (INCLUDING INSTALLATION) →	$	293,715
TOTAL SYSTEM COST	**$**	**-**	**TOTAL SYSTEM COST**	**$**	**293,715**
ANNUAL ESTIMATED OPERATING COST			**ANNUAL ESTIMATED OPERATING COST**		
ELECTRICAL COST	$	76,004	YEARLY MEMBRANE COSTS	$	1,250
→ FAN MOTOR HP		100	ANNUAL LISCENSE FEE	$	-
AMPERES		127.37	EVAC FILTER REPLACEMENT	$	840
KW		81.09	EVAC SYSTEM POWER COSTS	$	1,000
KWHOURS		710,322	YEARLY MAINTENANCE	$	500
→ COST/KWH	$	0.107			
MAKE-UP AIR COST (NO HEAT)	$	22,801			
→ FAN MOTOR HP		30			
AMPERES		38.21			
KW		24.33			
KWHOURS		213,097			
→ COST/KWH	$	0.107			
PUSH AIR BLOWER	$	38,002			
→ FAN MOTOR HP		50			
AMPERES		63.68			
KW		40.54			
KWHOURS		355,161			
→ COST/KWH	$	0.107			
ANNUAL SOURCE TEST →	$	10,000.00	**ANNUAL OPERATING COST**	**$**	**3,590**
WATER TREATMENT COSTS →	$	2,500.00			
ANNUAL MAINTENANCE COST →	$	1,500.00	FIRST YEAR EQUIPMENT COST	$	293,715
			FIRST YEAR OPERATING COST	$	1,000
ANNUAL OPERATING COST	**$**	**150,808**	**TOTAL FIRST YEAR COST**	**$**	**294,715**

COST SAVINGS

First Year Equipment Cost	$	-
First Year Operating Cost	$	150,808
Total First Year Cost	**$**	**150,808**

10 Year Estimated Cost		
Total Installation Cost	$	-
10-Year Operating Cost (per above)	$	1,508,080
Total Ten Year Cost	**$**	**1,508,080**

EED Payback Analysis		
Exhaust System Investment	$	-
EED System Investment	$	293,715
Equipment Savings	$	(293,715)
One-year Operating Cost Savings	$	150,808
Total Savings One Year	$	(142,907)
First Year Savings	$	(142,907)
Second Year Savings	$	147,218
Pay Back - Months		23.74
10 Year Estimated Cost		
Total 1st Year Cost	$	294,715
10-Year Operating Cost (per above)	$	32,310
Total Ten Year Cost	**$**	**327,025**

Projected Ten Year Savings	**$**	**1,181,055**

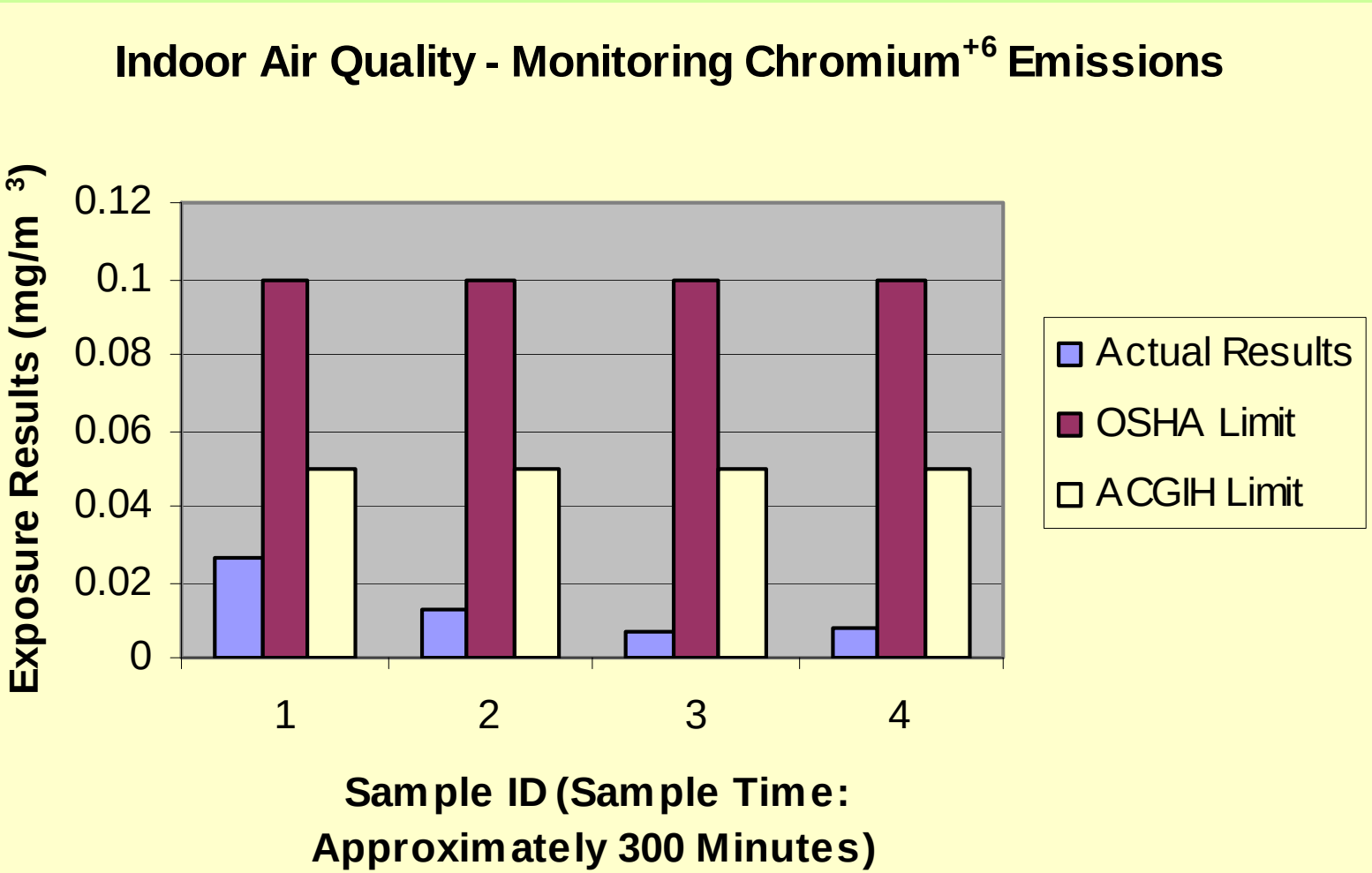
ADVANTAGES OF THE EED

SAFETY

- Reduced danger of hydrogen explosion; rectifiers are off during start-up – preventing arcing.
- The patented design allows hydrogen to freely leave the EED. In the unlikely event of an explosion, the EED shields the operator from any splashing solution.
- Potential hood or duct fires eliminated.
- Noise from fan and pump motors is eliminated.

- The potential for worker exposure is minimized when the EED is installed because no Cr^{+6} molecules are emitted to the atmosphere while plating is taking place.

AIR QUALITY MONITORING



ADVANTAGES OF THE EED

ENVIRONMENTAL

- **Air:** The need for exhaust hoods, ductwork and fume scrubbers/fans is eliminated.

Air: With a properly installed and operated EED system, emissions are eliminated.

- **Air:** Because no exhaust stacks are required, chrome fumes cannot escape into the atmosphere as they could if the scrubber system fails. The EED is environmentally friendly.

- **Water:** Effluent control for treating scrubber solutions is no longer required.

REGULATIONS

ADVANTAGES OF THE EED

- Since there are no exhaust stacks with the EED, no exhaust operational reports are required. Stack source testing is eliminated resulting in savings of $10,000 annually, as required by local regulatory authorities.

ADVANTAGES OF THE EED

PRODUCTION

- Because the EED includes a cover that must be opened, operators become more aware of their work habits. Production throughput will actually improve due this renewed attention to procedures.

CONCLUSIONS

The EED System, when operated properly, is a proven alternative control device that will meet or exceed all requirements of the Chrome Plating NESHAP while eliminating the need for conventional ventilation systems and fume suppressants. Due to the simple design and operation of the EED, significant savings are achievable using this technology when compared to conventional exhaust systems. In the particular case of the NADEP, as shown above, ten-year savings are estimated to be greater than $1.18 Million with an investment payback of approximately 24 months.